

## **Sustainable Hybrid System Deployment with the Navajo Tribal Utility Authority**

S. Begay-Campbell  
Sandia National Laboratories  
PO Box 5800, MS-0753  
Albuquerque, NM 87185-0753

### **ABSTRACT**

Sandia National Laboratories has an active relationship with the Navajo Nation. Sandia's activities with the Navajo Tribal Utility Authority (NTUA) are developing a sustainable tribal and rural cooperative solar program. Specifically, Sandia has provided technical assistance for NTUA's procurement of 45-hybrid systems, which includes PV and small wind turbines. Past assistance included support for NTUA's initial 640-Watt systems. Sandia's Solar Program has grown this relationship through joint formation of strategic multi-year plans oriented toward the development of sustainable Native American renewable energy projects and associated business development.

It is important that end users of these systems understand the system's capabilities and limitations. To communicate system capabilities, limitations and proper operation, the Sandia/NTUA team created a customer education video, "Power from the Sun" which is available in English and Navajo.

The NTUA Solar program serves as a model for other tribes, and their experiences can directly apply to rural utilities across the nation. If successful, the Program can lead to the opening of a large sustainable market for solar with the rural electrical cooperatives.

### **GENERAL INFORMATION**

In December 2000, Sandia National Laboratories, the Navajo Nation and the Department of Energy signed a Memorandum of Understanding (MOU), which authorizes collaboration and technology transfer for the Navajo Nation. The collaboration emphasizes energy, environment, education, economic development, and communication. Energy, of course, is very essential to the MOU. Besides being explicitly identified as a subject for cooperation, it is an enabler of all of the remaining explicitly mentioned cooperation areas.

On November 5, 2001, President Bush signed the Navajo Nation Electrification Demonstration Program (Section 602, Public Law 106-511) into Law. The basis of this law is for the Secretary of Energy to establish a 5-year program to assist the Navajo Nation in meeting its electricity needs for the estimated 18,000 occupied structures on the Navajo Nation that lack electric power.

On May 13, 2002, Navajo Tribal Utility Authority signed a Cooperative Agreement with the United States Department of Energy via Grant Application to receive \$800,000 for the Navajo Electrification Solar Project. In this agreement, NTUA has agreed to purchase 45 residential photovoltaic hybrid power systems for Navajo families living in the remote areas of the Navajo Reservation where it would be unfeasible to build power line extensions to these isolated home sites.

Out of the 250,000 enrolled members, approximately 152,200 Navajos reside on the reservation, which covers 17 million acres. The average cost to extend the electrical grid is about \$25,000 per mile.

NTUA serves as the Navajo's cooperative electrical utility and they have recently structured their PV work into a Solar Program. NTUA received the first non-hydro loan from USDA's Rural Utility Service (RUS) for \$4.8 million to expand this service.

Sandia's primary contact has been Paul Denetclaw, NTUA Electrical Engineering Supervisor. Larry Ahasteen now serves as the Program's Coordinator. Throughout the NTUA's service area, 200 640-Watt photovoltaic systems are in use and 44 new PV-hybrid systems have been assembled. Thirty-nine units have wind turbines and five have LP gas generators. All of the PV units with wind turbines have been installed, and installations are planned for the PV/gas systems.

## TECHNICAL ASSISTANCE

Sandia National Labs has been providing technical assistance and training to NTUA for their 640-Watt off-grid photovoltaic systems. Each system consists of a 640-W PV array, 876 Ah battery, 2.4-kVA inverter, battery charge controller, and associated electronics mounted on a self-contained steel skid. Sandia, along with DOE's Albuquerque Operations Office, reviewed NTUA's technical and cost analysis of the 2002 cooperative agreement.

Sandia and New Mexico State University's Southwest Technology Development Institute (SWTDI) partnered with NTUA's Solar Program to develop a set of specifications for NTUA's recent procurement of PV hybrid systems, which includes wind and back-up propane generators. Sandia's team included Sandra Begay-Campbell, Marlene Brown, Charley Hanley, Tom Hund, David King, and Joe Tillerson. SWTDI's Andy Rosenthal was also an integral part of the team.

Sandia and its partners at SWTDI have trained the majority of the NTUA's solar program staff including electricians, engineers and customer service technicians. Other assistance included monitoring performance/operation of PV systems in the field and conducting performance tests on NTUA's 640-watt systems at Sandia. It was recommended that additional PV panels be added to the systems for improved performance. Sandia recently supported NTUA's Solar Program team and the hybrid system contractors to train the electricians and customer service representatives on the new hybrid systems.

On December 19, 2002, NTUA invited and scheduled site visits with federal officials from the United States Department of Energy and Sandia National Laboratories to review and tour Photovoltaic installations in the Gallup, New Mexico and Window Rock, Arizona areas, to assure that the Navajo Tribal Utility Authority properly installed the hybrid systems.



## CUSTOMER VIDEO: "POWER FROM THE SUN"

Currently, Navajo customers lease the PV systems from NTUA and are charged through their utility bill. The lease includes NTUA-provided maintenance and service. All Balance of System components are sealed and accessible only to NTUA personnel. The customer owns the system after 15 years.

It is important that end users of these systems understand the systems' capabilities and limitations. For example, new users of the systems are so pleased with the benefits of having electricity in their homes for the first time that they attempt to power appliances and tools that overload the systems.

To communicate system capabilities, limitations and proper operation, the NTUA/Sandia team developed a customer education video, which will be available in both English and Navajo. The video is complete and NTUA will begin distributing copies to all the NTUA District Offices and also to the local TV network.

## FUTURE PLANS

With NTUA's agreement, Sandia's future plans include providing assistance on sustainability issues, maintenance process development and other technical training activities. To fully integrated with the entire Sandia solar program, Sandia also plans to determine life-cycle costs of fielded stand-alone PV systems based on monitoring and data collection from installed systems (especially system and component reliability data). Sandia's intent is to continue with technical assistance and capacity building, develop business partnerships geared toward sustainability and assist with the growth of present activities, monitoring and regular evaluation of installed projects, as well as the overall implementation plan.

## ACKNOWLEDGEMENT

This work is supported by the U.S. Department of Energy under Contract DE-AC04-94AL85000. Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the U.S. Department of Energy.